

SUPPORT FOR THE AMENDMENT

This Amendment cancels Claims 10 and 21-27; amends Claims 5-6, 9 and 13-20; and adds new Claims 28-30. Support for the amendments is found in the specification and claims as originally filed. In particular, support for Claim 5 is found in the specification at least at page 14, lines 9-23. Support for new Claims 28-30 is found at least in original Claims 1 and 6, respectively. No new matter would be introduced by entry of these amendments.

Upon entry of these amendments, Claims 1-7, 9, 11-20 and 28-30 will be pending in this application. Claims 1, 5 and 6 are independent. Claims 9, 14, 16-18 and 20 are withdrawn from consideration.

REQUEST FOR RECONSIDERATION

Applicants respectfully request entry of the foregoing and reexamination and reconsideration of the application, as amended, in light of the remarks that follow.

Applicants thank the Examiner for the courtesies extended to their representative during the September 23 and November 18, 2003, personal interviews.

As discussed at the personal interviews, the present invention provides a polishing liquid composition that, when used to polish a surface comprising an insulating layer and a metal layer, prevents the occurrence of dishing.

Claims 1-3, 7 and 11 are rejected under 35 U.S.C. § 102(b) over U.S. Patent No. 5,916,855 ("Avanzino"). Avanzino discloses a polishing slurry composition that can include a suspension agent formulated from glycols such as ethylene glycol and propylene glycol. Avanzino at column 4, lines 41-44. However, ethylene glycol lacks the R¹-X- group of the molecule represented by the formula (I) featured in independent Claim 1. Furthermore, propylene glycol lacks the -X- group of the formula (I). Because Avanzino fails to suggest

the molecule represented by the formula (I) of independent Claim 1, the rejection over Avanzino should be withdrawn.

Claim 4 is rejected under 35 U.S.C. § 103(a) over Avanzino and further in view of U.S. Patent No. 5,783,489 ("Kaufman-489"). Claim 4 depends from independent Claim 1. As discussed above, Avanzino fails to suggest the molecule represented by the formula (I) of independent Claim 1. Kaufman-489 fails to remedy the deficiencies of Avanzino. Thus, the rejection over Avanzino in view of Kaufman-489 should be withdrawn.

Claims 5 and 12 are rejected under 35 U.S.C. § 102(b) over Kaufman-489. Kaufman-489 discloses a chemical mechanical polishing (CMP) slurry comprising at least two oxidizing agents, an organic acid and an abrasive. Kaufman-489 at abstract. The CMP slurry has a low insulator polishing selectivity while exhibiting high polishing selectivities towards titanium, titanium nitride, and aluminum. Kaufman-489 at column 3, lines 1-4. Kaufman-489 discloses:

The CMP slurry of this invention includes an organic acid. A wide range of conventional organic acids, salts of organic acids, and mixtures thereof are useful in the CMP slurry of the present invention **to enhance the selectivity to oxide polishing rate**, such as monofunctional acids, di-functional acids, hydroxyl/carboxylate acids, chelating, non-chelating acids, and the salts. Preferably the organic acid is selected from the group of acetic acid, adipic acid, butyric acid, capric acid, caproic acid, caprylic acid, citric acid, glutaric acid, glycolic acid, formic acid, fumaric acid, lactic acid, lauric acid, malic acid, maleic acid, malonic acid, myristic acid, oxalic acid, palmitic acid, phthalic acid, propionic acid, pyruvic acid stearic acid, succinic acid, tartaric acid, valeric acid and derivative, including salts thereof.

The organic acid or salt should be present in the final CMP slurry, individually or in combination with **other organic acids or salts**, in an amount **sufficient to enhance the oxide selectivity** without detrimentally effecting the stability of the CMP slurry. Kaufman-489 at column 6, lines 1-19 (emphasis added).

However, Kaufman-489 fails to specify what "other organic acids or salts" can be in combination with Kaufman-489's organic acid or salt, and fails to suggest independent Claim 5's specific **combination of acids**, namely (i) an aliphatic carboxylic acid having 7 to 24

carbon atoms and/or a salt thereof" and (ii) "an etching agent comprising an organic acid ... selected from the group consisting of A: aliphatic organic acids having 6 or less carbon atoms and one to three carboxyl groups; B: aromatic organic acids having 7 to 10 carbon atoms and one to four carboxyl groups; C: organic acids having 6 or less carbon atoms and one to four phosphonic groups; and D: polyaminocarboxylic acids". Since the (i) aliphatic carboxylic acid having 7 to 24 carbon atoms and/or a salt thereof lowers the etching speed of metal, a practical polishing speed can be maintained and excessive etching of a metal layer, which leads to undesirable dishing, can be prevented by the combination of the (i) aliphatic carboxylic acid having 7 to 24 carbon atoms and/or a salt thereof and the (ii) etching agent. See, e.g., specification at page 18, lines 1-10. Since Kaufman-489 fails to suggest all the limitations of independent Claim 5, the rejection under 35 U.S.C. § 102(b) over Kaufman-489 should be withdrawn.

Any *prima facie* case for the obviousness of independent Claim 5 is rebutted by the significant reduction in dishing achieved by Claim 5's specific combination of (i) "an aliphatic carboxylic acid having 7 to 24 carbon atoms and/or a salt thereof" and (ii) "an etching agent comprising an organic acid" from the recited Markush group. See the Examples and Comparative Examples of Tables 3 and 4, which are reproduced below.

Table 3

Ex. No.	Aliphatic Carboxylic Acid and/or Its Salt		Etching Agent		Hydrogen Peroxide	Abrasive	pH
	Kind	Content	Kind	Content		Kind	
II-1	Octanoic acid	0.6 ¹⁾	Glycolic acid	2.0 ¹⁾	4.0 ¹⁾	Colloidal Silica	7.6
II-2	Nonanoic acid	0.3	Glycolic acid	2.0	4.0	Colloidal Silica	7.7
II-3	Heptanoic acid	1.2	Glycolic acid	2.0	4.0	Colloidal Silica	7.6
II-4	Decanoic acid	0.3	Glycolic acid	2.0	4.0	Colloidal Silica	7.7
II-5	Oleic acid	0.3	Glycolic acid	2.0	4.0	Colloidal Silica	8.0
II-6	Isooctanoic acid ²⁾	1.5	Glycolic acid	2.0	4.0	Colloidal Silica	7.7
II-7	Octanoic acid	1.2	Citric acid	2.0	2.0	Fumed Silica	7.6
II-8	Octanoic acid	1.0	Phthalic acid	2.0	2.0	Fumed Silica	7.9
II-9	Octanoic acid	1.5	Aminotri-(methylene-phosphonic acid)	2.0	2.0	Fumed Silica	7.6
II-10	Octanoic acid	0.4	Glycolic acid	2.0	—	Colloidal Silica	7.6
II-11	Octanoic acid	1.0	Hydrochloric acid	2.0	2.0	Colloidal Silica	7.7
II-12	Octanoic acid	0.5	Sulfuric acid	2.0	2.0	Colloidal Silica	7.9

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Ex. No.	Evaluation for Properties				
	Relative Polishing Speed	Relative Etching Speed	Comp. Ex. To Which Evaluation Was Based	Dishing	Copper Surface Condition
II-1	1.0	0.1 or less	Comp. Ex. II-1	Absence	No Roughening
II-2	1.0	0.1 or less	Comp. Ex. II-1	Absence	No Roughening
II-3	1.0	0.1 or less	Comp. Ex. II-1	Absence	No Roughening
II-4	0.9	0.1 or less	Comp. Ex. II-1	Absence	No Roughening
II-5	0.9	0.1 or less	Comp. Ex. II-1	Absence	No Roughening
II-6	1.0	0.1 or less	Comp. Ex. II-1	Absence	No Roughening
II-7	1.0	0.1 or less	Comp. Ex. II-2	Absence	No Roughening
II-8	0.9	0.1 or less	Comp. Ex. II-3	Absence	No Roughening
II-9	0.9	0.1 or less	Comp. Ex. II-4	Absence	No Roughening
II-10	0.9	0.1 or less	Comp. Ex. II-5	Absence	No Roughening
II-11	0.9	0.1 or less	Comp. Ex. II-11	Absence	No Roughening
II-12	0.9	0.1 or less	Comp. Ex. II-12	Absence	No Roughening

Note 1): % by weight

2): Secanoic C8 acid (trade name, commercially available from Exxon Chemicals K.K.)

Table 4

Comp. Ex. No.	Aliphatic Carboxylic Acid and/or Its Salt		Etching Agent		Hydrogen Peroxide	Abrasive	pH
	Kind	Content	Kind	Content	Content	Kind	
II-1	—	—	Glycolic acid	2.0 ¹⁾	4.0 ¹⁾	Colloidal Silica	7.6
II-2	—	—	Citric acid	2.0	2.0	Fumed Silica	7.6
II-3	—	—	Phthalic acid	2.0	2.0	Fumed Silica	7.9
II-4	—	—	Aminotri-(methylene-phosphonic acid)	2.0	2.0	Fumed Silica	7.6
II-5	—	—	Glycolic acid	2.0	—	Colloidal Silica	7.6
II-6	—	—	Glycolic acid	1.0	4.0	Colloidal Silica	7.6
II-7	Octanoic acid	0.5 ¹⁾	—	—	4.0	Colloidal Silica	7.8
	Heptanoic acid	0.5					
II-8	Oleic acid	0.5	—	—	4.0	Colloidal Silica	7.6
II-9	Benzo-triazole	0.3	Glycolic acid	2.0	4.0	Colloidal Silica	7.6
II-10	Ammonium Poly-acrylate	1.0	Citric acid	2.0	2.0	Fumed Silica	7.6
II-11	—	—	Hydrochloric acid	2.0	2.0	Colloidal Silica	7.7
II-12	—	—	Sulfuric acid	2.0	2.0	Colloidal Silica	7.9

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— Continued —

Comp. Ex. No.	Evaluation for Properties			Dishing	Copper Surface Condition
	Relative Polishing Speed	Relative Etching Speed	Comp. Ex. To Which Evaluation Was Based		
II-1	1.0	1.0	—	Presence	No Roughening
II-2	1.0	1.0	—	Presence	No Roughening
II-3	1.0	1.0	—	Presence	No Roughening
II-4	1.0	1.0	—	Presence	No Roughening
II-5	1.0	1.0	—	Presence	No Roughening
II-6	1.3	1.5	Comp. Ex. II-1	Presence	No Roughening
II-7	0.1 or less	0.1 or less	Comp. Ex. II-1	The polishing speed was too slow to be evaluated.	
II-8	0.1 or less	0.1 or less	Comp. Ex. II-1		
II-9	0.1 or less	0.1 or less	Comp. Ex. II-1		
II-10	1.2	0.1 or less	Comp. Ex. II-2	Absence	Presence of Roughening
II-11	1.0	1.0	—	Presence	No Roughening
II-12	1.0	1.0	—	Presence	No Roughening

Note 1): % by weight

Because Kaufman-489 fails to suggest the significant reduction in dishing achieved by independent Claim 5's specific combination of (i) "an aliphatic carboxylic acid having 7 to 24 carbon atoms and/or a salt thereof" and (ii) "an etching agent comprising an organic acid" from the recited Markush group, any *prima facie* case of obviousness based on Kaufman-489 is rebutted. Thus, Kaufman-489 fails to have rendered obvious independent Claim 5.

Claims 6 and 13 are rejected under 35 U.S.C. § 102(e) over U.S. Patent No. 6,063,306 ("Kaufman-306"). Kaufman-306 discloses a chemical mechanical polishing slurry that can include an organic amino compound such as nonylamine and dodecylamine. Kaufman-306 at column 6, lines 3-13. However, the singly substituted alkylamines of Kaufman-306 fail to suggest the triply substituted amine compound of independent Claim 6. Thus, the rejection over Kaufman-306 should be withdrawn.

Pursuant to MPEP § 821.04, after independent product Claims 1 and 6 are allowed, Applicants respectfully request rejoinder, examination and allowance of withdrawn method Claims 9 and 14-20, and examination and allowance of new method Claims 28-30, which claims all include all of the limitations of product Claims 1, 5 and 6, respectively.

In view of the foregoing amendment and remarks, Applicants respectfully submit that the application is in condition for allowance. Applicants respectfully request favorable consideration and prompt allowance of the application.

Should the Examiner believe that anything further is necessary in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below:

Respectfully submitted,

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